Can blockchain help improve financial inclusion? A comparative study

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Abstract

The financial inclusion of poor populations and/or refugees can be hindered by difficulties in proving or reluctance to disclose their identity. Bank accounts and mobile money services require that identities be provided. Financial digital services based on blockchain technology can provide anonymous authentication to poor/refugee populations and be a first step towards financial inclusion. We scrutinize several examples of such projects by comparing them with blockchain-based digital identity or financial inclusion programmes that are not necessarily restricted to poor/migrant populations. We use social network activity as a proxy for the failure or success of such projects. We find that blockchain projects targeted to migrants and poor individuals are more likely to fail than are those targeted to all. We more closely examine one particular case to check the consistency of our proxy. We present plausible explanations for our result: the discrepancy between the needs of populations of low socioeconomic status and the proposed blockchain-backed financial services and the fact that maintaining such services is energy intensive.

Keywords: blockchain, financial inclusion, refugees, Finland

JEL codes: F22, F24, E42, O15, O19, I38, G53

1 Introduction

Financial inclusion of a large part of a population is admittedly beneficial to development, however the fact that identity papers (henceforth "ID papers") are a necessary prerequisite for inclusion is often overlooked.

We focus on populations for which proving identity is more likely a problem: refugees and very poor, mostly homeless, populations. Without proof of identity, it is impossible for such individuals to open a bank account or even to obtain a phone with a Subscriber Identity Module (SIM) card and access mobile money payments. Refugees can be relatively wealthy, or have had bank accounts and savings in their home countries, but they may not have access to finance because of missing ID papers. For the homeless, proving residency is necessary to obtain ID papers. For the very poor, the notion of "financial identity" can be extended to the track record of economic transactions, which is not available for unbanked individuals, even when justifying a postal address. In that sense, the impossibility of certifying past transactions or income flows is, to some extent, comparable to an identity problem[1].

In such a context, blockchain technology can offer a solution because of its identity certification properties. When applied to cryptocurrency, this technology allows one to certify transactions without ID papers Indeed, such technology has already been tested in some projects throughout the world.

We study 32 projects implementing blockchain with a goal of financial inclusion and digital identity (to simplify, we call them "blockchain projects" hereafter). We separate projects according to their target. Some are explicitly targeted to poor, migrant, or refugee populations, while others do not have a particular target and are open to all individuals or businesses. To assess whether blockchain can help improve the financial inclusion of those with ID problems,

we compare the success of a project with a "migrants-poor" target, with the success of projects for which the target is "all". If projects are successful irrespective of their target, then we cannot rule out the hypothesis that blockchain projects are helpful. In contrast, if projects targeted at migrants and poor individuals fail more often, then this casts doubts on the usefulness of blockchain technology for populations with ID problems

We use the degree of activity on social networks as a proxy for the success and failure of such projects. We do so as a shortcut to identify explicit information because persons in charge of a failed project generally do not advertise it.

We find that projects with "migrants-poor" targets tend to have significantly lower activity on average compared to those with "all" as the target; thus, we conclude that the former is more likely to fail than are "standard" blockchain projects. We document such likely failures for one of such projects.

The originality of our contribution lies mainly in its policy-relevant analysis of whether blockchain helps improve the financial inclusion of poor and/or refugee populations, through digital ID certification. To the best of our knowledge, this work is the first research attempt in this direction.

2 Literature review

Financial inclusion is a stepping stone for low- and middle-income countries (Allen et al., 2016; Duvendack & Mader, 2020), and access to formal financial services is an important way for poor populations across all countries to benefit from less costly payment instruments, lower interest rates, and eased savings management.

The next step is to consider that "digital financial services", foster financial inclusion (Demirgüç-Kunt et al., 2018). Such services could spare a developing country from having to install a full banking infrastructure, and jump directly to a digital finance economy (Aron & Muellbauer, 2019).

However, to open a bank account or a financial account for a mobile phone with a SIM card, one needs an ID; thus, financial inclusion can pose a particular problem for poor individuals and/or refugees[2] because of their inability or unwillingness to prove their identity. ID papers may have been lost, stolen, or retained by someone else. For poor populations in rich countries, it is necessary to have an address to obtain an ID. However, an extension of this "identity problem" could exist, for example, when banks require a good credit and transaction history as a condition to provide services, which is impossible to prove after having repaid small loans or earned income in the form of cash[3]. For refugees, administration archives may have been destroyed by war. Alternatively, authorities may not be willing to respond to refugees if they are suspected of being opponents. Finally refugees themselves can be reluctant to reveal their identity[4].

The blockchain technology applied to cryptocurrencies and financial services precisely aims at handling the privacy problem and enabling trust in transactions. The World Bank mentioned that "at least a billion people (…) lack any form of officially recognized ID (...) Digital identity, combined with the extensive use of mobile devices in the developing world, offers a transformative solution to this global challenge and provides public and private sector entities with efficient ways to reach the poorest." (Clarck et al., 2016, p. 7).

A first strand of literature relied on blockchain's potential to improve financial inclusion. Larios-Hernández (2017) showed that blockchain can foster business opportunities, while

Blakstad and Amars (2020) assess that blockchain-based solutions can help bridge the gap between formal finance and rural areas in Niger. Moreover, Schuetz and Venkatesh (2020) argued that blockchain has the potential to improve the situation of poor individuals in rural areas in India. Flore (2018) explained that the use of blockchain-based technology in cross-border transactions may reduce costs by up to 60% compared with traditional bank or agent intermediation but also allows for individuals to trade without being forced to reveal their identity. For homeless individuals, cryptocurrencies can also provide a second means of payment, instead of them having to rely exclusively on cash (Schoeni and Koegel (1998) and Sarkar et al. (2021) show the crucial importance of cash for homeless individuals). .

A second strand of literature relied on blockchain with digital identity. For example, Sarker et al. (2021) showed that identity is one of the core problems leading to corruption in global shipping, arguing that blockchain can help fight against corruption because it securely records all transactions. In contrast, it can be argued that cryptocurrencies fuel corruption and/or money laundering precisely because they preserve anonymity, however, Turner and Irwin (2018) presented techniques to deanonymize identity in suspicious and illicit bitcoin transactions. Furthermore, Naheem (2019) showed that blockchain can help prevent money laundering, notably by securing identity for beneficial ownership and, thus, can be appliedin countries where notaries (or similar institutions securing property) are absent or unreliable. Finally, standard credential ID systems are not robust against some users lending their credentials to others, which may apply to populations that lack resources such as that in the present study, while Sarier (2021) showed that blockchain can precisely build nontransferable digital credentials.

However, although several projects have been launched, only a few of them have been studied in the academic literature. In Kenya, Karanja and Korin (2019) described a blockchain-

based digital ID implemented in refugee camps, while in Jordan, the "Building Blocks" programme from the World Food Program has implemented a form of electronic cash aid distribution in partnership with participating markets (Riani, 2018). Moreover, in Uganda, Zimbabwe and South Africa, a startup called Wala tried implementing access to financial services through bitcoin (di Prisco & Strangio, 2021). However, the mismatch between the socioeconomic status of the target population and the bitcoin features led Wala to cease activity three years after its inception.

Complementing these studies, the present article aims to fill this gap in the literature.

3 Comparative study design and main hypothesis

After some preliminary research, we gather information about projects that use blockchain for "good", as listed on the website *positiveblockchain.io*. We then restrict the sample to companies/projects responding to the keywords "financial inclusion" and "digital identity". Then we analyse the text information provided by projects. We perform a textual analysis to assess the target audience for each project. Because the body of these data is modest, we choose to apply conventional content analysis (Hsieh & Shannon, 2005; Oleinik, 2022). For each project, the variable *target* is determined as follows. If the description of the project shows words like "poor", "poverty", "unbanked", "migrants", and "asylum seekers", with those being the only beneficiaries of the project, then we code the *target* as "migrants-poor"[5]. In contrast, if the description of the project shows words like "people", "businesses", and "everyone" and does not explicitly restrict participants to being migrants or poor, then we code the *target* as "all". Typically, a crowdfunding, blockchain-based platform that entices wealthy persons to become

involved in projects to reduce poverty is coded as "all" because, this type of platform is not addressed to poor populations only.

We want to assess whether the blockchain projects aimed at migrant-poor individuals are helpful, i.e., are likely to succeed. However, failed projects are typically not advertised.. Thus, it is difficult to find official information about the true outcomes of these projects. For this reason, we use activity on internet social networks as a proxy for project success or failure. We posit that a project for which there are numerous and/or regular "posts" on social networks is more likely to be a success than is that for which there is little activity.

We measure social network activity with different variables related to posts and date of posting and compare these measures with the variable *target*. We conduct nonparametric tests to assess whether projects targeted at "migrants-poor" have significantly lower activity than do those targeted at "all". If so, then we conclude that blockchain projects targeted at migrant-poor individuals are less likely to be successful.

4 Data and results

4.1 Data description

A first exploration shows that Facebook and Twitter are the most frequently used social networks among blockchain projects listed on positiveblockchain.io. We drop projects without a profile on at least one of these two networks. Among the 32 remaining projects, 30 and 18 have a Twitter profile and a Facebook profile, respectively (see Table A.1 for details). For this reason, the next section presents the results for Twitter only[6]. Concerning the variable *Target*, 22 projects are coded as "all", and 8 projects are coded as migrants or poor individuals (see Table A.2 for a short

description of these projects). We especially focus on the following variables: *NbTweets* (number of posts since profile creation), *NbMonthTwt* (number of months elapsed since profile creation), *NbFollowers* (number of followers indicated on the profiles) *NbDaysElapsed* (number of days between the date of the last published post and the date of database construction), and *TweetsPerMonth* (number of tweets divided by the number of months since profile creation). We create the variable *KeywordDummy* according to the keyword (digital identity vs. financial inclusion) attached to each project[7] . Table 1 provides the other summary statistics considered.

[Insert Table 1 HERE]

We observe that projects targeted at migrant-poor individuals post fewer tweets on average (1,085 vs. 2,177) and have a lower median number of tweets (492 vs. 1,108) compared to those targeting "all". The average and median number of posts per month is also lower (17.7 vs. 25.9 and 5.5 vs. 16.5 posts per month, respectively, between the two targets). The same applies to the number of followers (however, the standard deviation of the number of followers is important for the "all" target), with an average of 1,445 vs. 45,165 and a median of 510 vs. 4,177 followers. Finally, the "migrants-poor" target exhibits a higher number of days since last post (802 on average vs. 249, with a median of 765 vs. 69, respectively) compared to the "all" target. Taken together, these results show that blockchain projects targeted at migrant-poor individuals have lower activity on social networks than do those targeting "all"[8].

4.2 Test results

In Table 2, we report the results[9]. We compare projects targeted at "all" with those targeted at "migrants-poor" with respect to *NbFollowers, NbDaysElapsed,* and *TweetsPerMonth*. The test indicates that blockchain projects for migrants-poor individuals have a lower number of

followers and a higher number of days elapsed since the last post compared to those projects targeting "all". However, the number of Tweets per month do not appear to significantly differ. It can be seen from Table A.1 that many projects targeted at "all" are also likely to have failed.

[INSERT TABLE 2 HERE]

To verify that these results are not driven by a difference in the type of projects as subsumed by their search keywords (focus on "digital identity" vs. "financial inclusion"), we test whether the groups differ in terms of *KeywordDummy*. Table A.3 shows that this variable does not significantly differ across target groups (there are comparable proportions of keywords in the two target groups). Furthermore, *NbFollowers*, *NbDaysElapsed*, and *TweetsPerMonth* do not differ across keywords. Hence, we believe that our main results are not biased by project orientation.

This leads us to further consider that we cannot reject the idea thatthat blockchain projects targeted at migrants- poor individuals fail more often than do those targeted at "all".

4.3 Consistency check: case study focus

As a consistency check for the approximation of a project's failure using social network activity, further research can conduct qualitative analysis of those cases with low activity. Indeed, a well-functioning project can decide that there is no need for it to have a Twitter page, thus not representing a failure. We conduct such an analysis for the case of the partnership of the Finnish immigration service (Migri) with the FinTech firm Moni, originally designed to provide digital identity and financial inclusion to refugees in Finland. The conclusion is that this project failed, which is consistent with our approximation[10].

Let us, first, recall the project inception and, second, give anecdotal evidence of the failure of the project. The pilot project was launched in 2015.

Interestingly, the burden of understanding the architecture is not on the users (refugees) but rather on the FinTech firm (Rayner, 2018). This project, using Ethereum—a blockchain-backed currency—starts with the (encrypted) identity to provide a simple payment card (in this case, a Mastercard). This allows refugees to receive wages and pay bills electronically. In contrast, because transactions are recorded on the blockchain, authorities can monitor where refugees are spending their money (however, this tracking information is anonymized).

Although there was much enthusiastic information (on social networks, in the press or on specialized websites) about this project until 2017-18, there has been far less afterwards. The first Tweets of physical persons mentioning "problems" started in November 2018. Then, in October 2020, Migri warned Moni cardholders that they should withdraw funds and announced that in July 2020, it filed an investigation request with the police regarding the funds remaining on clients' Moni cards. Finally, in January 2022, Migri announced the following: "On 26 March 2021, the Helsinki Police Department decided not to initiate a criminal investigation because it found that there are no grounds to suspect Moni Nordic of a criminal offence in the matter (…) The Finnish Immigration Service and reception centers do not have access to the Moni card account information. Therefore, we are unable to return the missing funds (Maahanmuuttovirasto Migrationsverket Finnish Immigration Service, 2022)". This statement clearly indicates not only the failure of the project but also that missing funds were thus due to migrants[11].

5 Discussion

Our research is a first attempt in its field and has several limitations, the main one of which relates to the coding of our variable *target* because it is the pivotal variable in our analysis. A deeper examination could propose that a third party read the project description, code the target, and compare his or her coding to ours. The information search could also be extended to the whole web. A supplementary problem arises considering that the target could change over time[12]. . One could argue that a successful project does not necessarily have to be active on social networks. Nevertheless, we believe that it is very unlikely that a project does not advertise its success at least once or twice per year especially when multiple posts were published in the first months after its inception.

Our main conclusion—that blockchain projects that provide digital identity for financial inclusion fail more often when targeted at migrants and poor individuals than when targeted at "all"—requires further explanation.

In line with di Prisco *et al.* (2019), we believe that the low socioeconomic status of the target audience is a key explanation because of a mismatch between the needs of the audience and what blockchain technology can offer. Relatedly, in computer science, Naik et al. (2022) showed that self-sovereign identity services can suffer attacks because "not all users are capable or trained in their use and therefore in their efficient application". In short, not only financial literacy but also a minimum level of technological literacy, or simply trust in blockchain technology, is needed.

A final explanation might seem obvious but is often overlooked: blockchain requires electricity, thus leading to a vicious circle: without an ID, it is not easy for individuals to pay energy bills, which would provide them with access to a blockchain that helps them obtain a digital ID.

Tables

Table 1 Summary Statistics

target		*Nb Tweets*	*NbMonth Twt*	*TweetsPer Month*	*NbFollowers*	*NbDays Elapsed*
all	N	22	22	22	22	22
	mean	2177.0	67.5	25.9	45165.2	249.5
	standard dev.	3763.0	30.3	25.7	159097.7	371.0
	median	1108.5	62.5	16.5	4177.5	69.5
migrants-poor	N	8	8	8	8	8
	mean	1085.8	67	17.7	1445.3	802.5
	standard dev.	1166.6	15.8	22.1	2131.2	787.0
	median	492.5	63	5.5	510	765.5
Total	N	30	30	30	30	30
	mean	1886.1	67.3	23.7	33506.6	397
	standard dev.	3289.9	27.0	24.7	136810.9	557.7
	median	936	62.5	15	2113	99

Source: Authors. In each cell, the first number is the number of observations, the second is the mean value of the variable, the third is the standard deviation, and the fourth is the median.

Table 2 Rank Sum Test

	Tweets Per Month		*Nb Followers*		*Nb Days Elasped*	
target	Obs	Rank sum	Obs	Rank sum	Obs	Rank sum
all	22	395	22	369	22	303.5
migrants-poor	8	70	8	96	8	161.5
Combined	30	465	30	465	30	465
Mann-Whitney U	62.0		34.0		53.0	
Wilcoxson W	98.0		70.0		306.0	
z-stat	1.315		2.523		-1.761	
Exact Prob.	0.197		0.009***		0.081*	

Source: Authors. Because the normal approximation may not be precise in a small sample, we use the exact p value. *** indicates that the target groups differ at the 1% level, ** at the 5% level, and * at the 10% level.

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Appendices / Online Appendices: Supplementary Information, not to be included in the paper

Table A.1 Social network activity of blockchain projects

Name	Target	Tweeter Page	start date on tweeter	nb Tweets	Nb months Twt	Tweets Per Month	Tweets per week	Intensity of Tweets	nb followers Twt	Month accessed Twt	Day accessed Twt	days Elapsed Since Last Post	FB page	start date FB	nb Months FB	nb followers FB	Month accessed FB	day accessed FB	days elapsed since last post	Dummy (DI=1; FI=2)
Abt Associates (project with Papua New	all	yes	01/04/2009	17900	161	111,2	27,8	Adequate	14996	Sep-22	12/09/22	0	no							1
Arcadia Blockchain Technologies	migrants	yes	01/06/2018	3309	51	64,9	16,2	Low	521	Sep-22	16/09/22	3	yes	04/07/19	38	133	Sep-22	16/09/22	1030	2
BanQu	poor	yes	01/01/2016	2127	80	26,6	6,6	Very low	2534	Sep-22	11/09/22	85	yes			9200	Sep-22	11/09/22	530	1
Blockchain HELIX	all	yes	01/04/2016	1167	77	15,2	3,8	Very low	1323	Sep-22	11/09/22	8	no							1
BrightID	all	yes	01/05/2018	783	52	15,1	3,8	Very low	386	Sep-22	09/09/22	1	no							1
Change Bank	all	yes	01/05/2016	679	76	8,9	2,2	Very low	10600	Sep-22	16/09/22	44	yes	07/12/19	38	256	Sep-22	16/09/22	340	2
Coins.ph	all	yes	01/02/2014	5004	103	48,6	12,1	Very low	41631	Sep-22	15/09/22	0	yes	Sep- 2017	60	100.4B	Sep-22	15/09/22	298	2
Diwala	all	yes	01/05/2017	494	64	7,7	1,9	Very low	806	Sep-22	09/09/22	1	yes	15/05/17	64	1900	Sep-22	09/09/22	1	1
Empowa	all	yes	01/04/2021	1089	17	64,1	16,0	Low	11800	Sep-22	16/09/22	1	yes	12/10/21	11	124	Sep-22	16/09/22	175	2
Ethecal	poor	yes	01/07/2018	111	50	2,2	0,6	Quasi Inactiv	153	Sep-22	16/09/22	1204	yes	28/07/18	50	83	Sep-22	16/09/22	1234	2
Ethic Hub	all	yes	01/08/2017	3054	61	50,1	12,5	Very low	9201	Sep-22	16/09/22	3	yes	03/11/17	66	6546	Sep-22	16/09/22	16	2
Finnish Immigration Service & MONI	migrants	yes	01/11/2014	512	94	5,4	1,4	Very low	356	Sep-22	12/09/22	1956	no							1
FinTrux	all	yes	01/08/2017	516	61	8,5	2,1	Very low	3482	Sep-22	13/09/22	1031	yes	19.08.2017	61	1.7B	Sep-22	13/09/22	814	2
Fummi	poor	yes	01/03/2017	153	66	2,3	0,6	Quasi Inactiv	383	Sep-22	09/09/22	1598	yes	14/09/17	60	19220	Sep-22	09/09/22	1598	1
Iden3	all	yes	01/06/2018	618	51	12,1	3,0	Very low	2950	Sep-22	11/09/22	592	no							1
Jolocom	all	yes	01/01/2016	2339	80	29,2	7,3	Very low	1692	Sep-22	12/09/22	5	yes			715	Sep-22	12/09/22	1047	1
Kora network	poor	yes	01/09/2017	308	60	5,1	1,3	Very low	6382	Sep-22	13/09/22	4	no							2
Land LayBy Listing	all	no											yes	24/11/17		38698	Sep-22	12/09/22	1089	1
Libra/Diem	all	yes	01/06/2019	161	39	4,1	1,0	Very low	69200	Sep-22	16/09/22	228	yes	31/05/19	40	71687	Sep-22	16/09/22	638	2
Moeda	all	yes	01/03/2017	2207	66	33,4	8,4	Very low	8534	Sep-22	13/09/22	110	yes	21.03.2017	66	70,425	Sep-22	13/09/22	11	2
PayCase	all	yes	01/07/2014	488	98	5,0	1,2	Very low	747	Sep-22	15/09/22	396	yes	01/04/16	77	223	Sep-22	15/09/22	1329	2
Pesabase	all	yes	01/07/2017	1128	62	18,2	4,5	Very low	4873	Sep-22	13/09/22	103	yes	25.08.2017	61	2.1B	Sep-22	13/09/22	3	2
Serto	all	yes	01/01/2021	57	20	2,9	0,7	Quasi Inactiv	796	Sep-22	11/09/22	383	no							1
Stellar	all	yes	01/04/2014	4717	101	46,7	11,7	Very low	753063	Sep-22	14/09/22	1	no							2
Tael/Wabi	all	yes	01/07/2017	2115	62	34,1	8,5	Very low	44700	Sep-22	09/09/22	102	no							1
Taqanu	migrants	yes	01/02/2016	473	79	6,0	1,5	Very low	499	Sep-22	14/09/22	1243	no							2
The Digital Reserve	all	yes	01/10/2017	1168	58	20,1	5,0	Very low	301	Sep-22	16/09/22	640	yes	21/10/17	59	224	Sep-22	16/09/22	1010	2
Trustlines	all	yes	01/12/2018	512	45	11,4	2,8	Very low	1320	Sep-22	13/09/22	95	no							2
Uport	all	yes	01/08/2016	1433	73	19,6	4,9	Very low	10996	Sep-22	11/09/22	490	no							1
Uulala	poor	yes	01/01/2018	1694	56	30,3	7,6	Very low	735	Sep-22	15/09/22	327	no							2
Value Instrument	all	no											yes	01/10/18	47	74	Sep-22	15/09/22	1024	2
Waba	all	yes	01/12/2017	267	57	4,7	1,2	Very low	238	Sep-22	16/09/22	1345	no							2

Source : Authors.

Target : coded "all" if the project description do not restrict its use to migrants and/or poor populations. Coded "migrants" or "poor" if the project description explicitely restrict its targeted users to those. In the tests those two categories are merged as "migrants-poor". *Twt* stands for tweeter and *FB* for facebook. *NbMonths* is the time elapsed, in months, between the start date, and day of access. The *nb followers* is the number of followers mentionned at the day of access. *Days elapsed since last post* is the time elapsed between the date of the last proprietary post published (not only a "re-tweet" for example), and the day of access. The "nb of posts" is not publicly available on FB. *Tweets per months* is *nb tweets* divided by *Nb months twt*. *Dummy* is 1 if the project was tagged as Digital Identity (DI) and by 2 if it was tagged as Financial Inclusion (FI) on positiveblockchain.io.

Table A.2 Project description

Name	Short Description
Abt Associates (project Papua New G)	An MOU with the Central Bank of Papua New Guinea to pilot blockchain-based efforts to establish and confirm identify and improve financial inclusion in Papua New Guinea
Arcadia Blockchain Technologies	Our software enables NGOs and aid organizations to offer peer-to-peer financial services to refugees and other marginalized communities.
BanQu	The first Economic Identity technology that enables a secure and immutable platform for creating economic opportunity for everyone, focusing on economic identities and extreme poverty
Blockchain HELIX	Helix id is a Digital Identity ecosystem for individuals and corporates to overcome the trustless society
BrightID	An identity network with a mission to bring the benefits of being verified as a unique person to everyone
Change Bank	A new age financial proposition for individuals with high financial ambitions.
Coins.ph	A mobile wallet that allows you to pay bills, buy load, send money and more - no bank account or credit card needed.
Diwala	A digital economy platform powered by blockchain that enables people to actively build their identity & skills.
Empowa	The platform to enable African communities to improve living conditions and create wealth, initially through property
Ethecal	An ecosystem based upon blockchain technology and smart contracts to financially empower individuals to break the cycle of poverty.
Ethic Hub	Crowdlending with social impact
Finnish Immigration Service & MONI	The Finnish Immigration Service has been giving asylum seekers who don't have bank accounts prepaid Mastercards instead of the traditional cash disbursements, and today the program has several thousand active cardholders. Developed by the Helsinki-based startup MONI, the card is also linked to a unique digital identity stored on a blockchain, the same technology that underpins the digital currency Bitcoin
FinTrux	Smart financial and business solutions to foster SME growth, built on the blockchain
Fummi	A digital blockchain platform with Smart ID and Alternative Financial Services for homeless people
Iden3	A technology anybody can create as many blockchain-based identities as he wants. Anything can have its own identity: a person, an entity, an organization, a bot, an asset,..
Jolocom	A decentralized system for creating and sharing digital identity
Kora network	An online cross-border payments solution that leverages cutting edge technology including Blockchain settlement to lower the cost of remittance while increasing the speed of individual and business payments into and within Africa.
Land LayBy Listing	Leveraging on the blockchain technology, Land LayBy is building Land LayBy Listing; a trusted shared distributed ledger for recording land buying and selling transactions that can never be altered, corrupted, forged or replicated in error.

Table A.2 (continued)

Libra/Diem	The mission for Libra is a simple global currency and financial infrastructure that empowers billions of people. Moving money around the world should be as easy and cheap as sending a text message. No matter where you live, what you do, or how much you earn.
Moeda	A cooperative banking-as-a-service fintech powered by blockchain, built for everyone
PayCase	A mobile-first universal banking platform that leverages bitcoin & blockchain technology
Pesabase	A remittance, payment and banking e-wallet solution that uses the OmiseGo blockchain to provide financial simplification and inclusion in Africa.
Serto	
Stellar	A free, open-source network that lets anyone build low-cost financial products for their community, connecting banks, payments systems, and people
Tael (WABI token)	The first fair reward for consumer contributions, in an ecosystem of safe and authentic products
Taqanu	A globally accessible, secure and self-owned digital identity platform for refugees and people without an address
The Digital Reserve	A P2P payment and lending network that leverages Denarii – a specialized cryptocurrency designed to meet the needs of everyday people
Trustlines	Aims to promote financial & economic inclusion of all people through decentralized and open source systems
Uport	A self-sovereign identity and user-centric data platform built on Ethereum: the keys to the digital world you've always wanted.
Uulala	Empowers the underbanked communities of the world by providing access to the financial tools they need and the entertainment they desire.
Value Instrument	We provide a meta-tool, for designing and deploying your own complementary cryptocurrency, which can even include a basic income for each of your community members. The mechanism we designed is one supported implementation. It’s down to your community to choose the settings.
Waba	A decentralized open platform that hosts and connects economic hubs in which money and market are governed by the communities

Note. The "short description" is self-reported by projects, and is provided by positiveblockchain.io

Table A.3 Tests for the "keyword" dummy

	Tweets Per Month		*Nb Followers*		*Nb Days Elasped*	
Keyword Dummy	Obs	Rank sum	Obs	Rank sum	Obs	Rank sum
Digital Identity	12	181	12	178	12	187
Financial Inclusion	18	284	18	287	18	278
Combined	30	465	30	465	30	465
Mann-Whitney U	103.0		100.0		107.0	
Wilcoxson W	181.0		178.0		278.0	
z-stat	-0.212		-0.339		-0.042	
Exact Prob.	0.882		0.735		0.966	

Source: Authors. Because the normal approximation may not be precise in a small sample, we use the exact p value. *** indicates that the target groups differ at the 1% level, ** at the 5% level, and * at the 10% level.

[1] There are relations among the notions of money, access to credit, and record-keeping. See Kocherlakota (1998) and Luther and Olson (2015).

[2] Although they differ in some aspects (in particular, a refugee may not necessarily be poor), in this article, we treat populations as having a common characteristic: being financially excluded notably because of identity problems.

[3] As evoked in a previous note ([2]), as currencies are anonymous (as has traditionally been said, goods and services must be delivered to the bearer, regardless of who he or she is, of currencies on demand), it is difficult to signal a "good" track record of credit and transactions payments to a third party when using cash only. In other words, it is difficult to prove "who you are" in financial terms.

[4] Latonero et al. (2019) provided an insightful field study with migrants' testimonials. Some migrants noted that they fear being tracked and sent back to their home countries. Moreover, the field interviews in the aforementioned study indicated that migrants also care about privacy and exhibit a certain mistrust about official organizations; e.g., "when you arrive, all you have is your name, surname… You have to give it everywhere. [You] don't know what happens. What are they asking for it?" (Latonero et al., 2019, p. 5).

[5] Initially, there are two categories, but as the data description table shows, there are not enough projects in each category to perform robust statistical tests. We then merge these projects and call their target "migrants-poor" and, sometimes, "migrants" for short.

[6] Results for Facebook present qualitatively similar results and are available as Supplementary Information upon request from authors.

[7] Among those projects targeting migrants and poor individuals, 3 are tagged as digital identity and 5 are tagged as financial inclusion, and among those projects targeting "all", 9 are tagged as digital identity and 13 are tagged as financial inclusion, which makes the odds of a project being tagged as these two factors quite similar.

[8] Interestingly, both targets show a similar history: their average "age" is approximately 67 months, with similar medians, dating the average mushrooming of blockchain projects back to around early 2017.

[9] In unreported results, we first confirm that the observations are not normally distributed, and thus, we undertake nonparametric tests.

[10] In Table A.1, we see that the Twitter page, started in 2014, shows no news since early May of 2017. Moreover, 1,956 days had elapsed until the day of access in September 2022.

[11] Further inquiry should be conducted to understand what happened, most notably by translating Finnish documents. We use only documents originally available in English.

[12] However, we observe only one case in which coding could become debatable: the Kora project. At its inception in 2017, this project emphasized helping "poor" individuals. Five years later, in 2022, it touts that it helps "businesses", which would entail an "all" type of coding. However, we code this project as helping "poor" individuals. This choice turns out to not support our hypothesis, as this project has a very active profile. Nevertheless, this situation does not qualitatively change our result. In fact, coding this project as "all" would even strengthen our conclusion.